Abstracts

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IFAD
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Rice Wheat

factors directly underlying those criteria. This emphasis on economics alone decries the importance of several other system attributes properties. Hence, a pragmatic and holistic approach to ascertain the sustainability of a farm is essential. A pioneering holistic sustainability evaluation of diversified cropping systems through the extensive two-year on-farm studies undertaken in farmers' field as part of the research projects of the Planning Commission of India in Palakkad and Wayanad Districts of Kerala, India which are representative of the intense and diversified cropping systems in tropical developing counties is presented. The different facets of sustainability analysis of diversified cropping/farming systems include level of biodiversity, quantum of external inputs, labour requirement and employment generation, biomass generated and recycled, number of bioresource cycles, economics, temporal changes in soil fertility, nutrient budget and balance, moisture conservation, soil microbial load especially of plant growth promoting rhizobacteria and other beneficial organisms, pest/disease incidence and system stability, socio-economic aspects, energetics and nutritional security.

Upland Cropping Systems to Produce Staple Food and Milk on the Malagasy Highlands

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In Malagasy highlands, increasing demand for rice led to the improvement of upland rice in the hilly areas due to increasing land pressure in the lowland areas. To tackle the problem of sustainable upland crop production systems, CIRAD (IGO) and TAFA (NGO) have developed Direct-seeding Mulch-based Cropping systems (DMC), which does not only conserves soil from erosion but also increases soil fertility. In the highlands, livestock for the dairy production is growing very rapidly with the main constraints of limited availability of the forage resources. During last years, agriculture extension agencies like FIFAMANOR, TAFA, and other NGOs have developed an approach aiming to integrate agriculture and livestock. In this context, studies were undertaken on some grasses and legumes for their multiple uses as cover-crop and forage for dairy livestock. To technically support these studies, further work has been conducted with the objective to develop sustainable upland crop production system based on rice, maize, and forage. For this study, upland rice was cropped in double lines associated with various plants *Eleusine coracana*, *Stylosanthes*, *Cajanus cajan*, *Raphanus sativus* and *Vicia villosa* with the mixtures of forage crops. Similarly, maize (in rotation with rice) was cropped in association with *Cajanus cajan*, *Raphanus sativus*, *Eleusine coracana*, *Crotalaria grahamiana, C. spectabilis*, *Lupinus sp.*, *Stylosanthes guianensis* and *Brachiaria ruziziensis* with the mixtures of forage crops. These systems are compared for the competition and complementarities between crops in terms of grain yield of rice and maize, and biomass production.

During the wet season of 2006-07, rice cultivar sensitive to the pyricularia was used for the experiment to observe the effect under normal incidence of the disease. But, incidence of the disease was too strong causing very low grain yield to observe the effect of association. The best rice yield was obtained in pure culture and in association with *S. guianensis* (1.50 t ha^{-1}), while the highest total biomass was observed in the associations with *R. sativus* and the mixture of forage crop (3.75 t ha^{-1}). In case of maize, the associations with *E. coracana* and *Crotalaria* sp. were found most effective for production of both grain and the biomass. In the wet season of 2007-08, rice cultivar resistant to the pyricularia was used with two types of fertilizers both organic (Fu) and organic mineral (FM). But, the cyclone during flowering stage induced high percentage of sterility (74%) and very poor grain yield. In this year, *S. guianensis* was left in the field for one more year without harvesting it. The highest biomass production was obtained from *R. sativus* sown 1 month after rice (7.00 t ha^{-1}) in FM treatment in which the rice grain yield was found very low because of a strong competition between two crops. The associations with *C. cajan* and *E. coracana* were the most effective in term of rice grain yield and biomass production. The highest maize grain yield was observed in association with *Lupinus sp.* sowed

simultaneously (2.45 t ha^{-1}) in FM treatment. Whereas, the lowest maize grain yield was observed in association with *B. ruziziensis* (1.09 t ha^{-1}) in FM treatment. The better yield was found in FM treatment as compared to Fu treatment. As for rice, the highest biomass production of the associated crop is linked with the lowest grain yield. The most effective associations for maize grain yield and biomass production of the associated crop were observed in *E. coracana* + *C. cajan* and *R. sativus* + *Vicia villosa*. These preliminary results help to estimate the quantities of biomass produced under the stringent condition of Malagasy highland (rainfall and temperature). Further experiment will be conducted to estimate the balance between amount of biomass needed for mulching the field and the potential biomass that can be used for cattle feeding.

Conservation Agriculture: Indian Perspective

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Conservation Agriculture is a new “Term” in vogue. Perhaps, apart from old terms of natural resource/ soil and water/ forest conservation it includes new terms of bio-diversity conservation/ watershed management/all inclusive agriculture and technologies. Some of the new technologies could be “minimum tillage. It is not clear whether the new term “Conservation Agriculture” takes into account the “socio-economic conditions” of a particular society in account. When the “new technology” of “Green Revolution” came to India, it was immediately taken up because the pre-requisites required (namely irrigation, fertilizers and agents of change) were available. However now the green revolution has lost its steam and perhaps is beset with problems. The dryland/ rainfed agriculture is waiting for a revolution. “White revolution”, “Yellow revolution” and “Egg Revolution” are indigenous to India as they fitted in with the local socio-economic conditions. With respect to conservation of natural resources (soil/water/forest) India has a historical/ civilizational/traditional technologies for various agro-ecological / land/ rainfall/ geomorphologial / socio-economic conditions.

Some of the most successful examples are (i) bench terraces/water resource development/integration of crops-trees-animals/seed/food preservation, (ii) in high rainfall tropical/sub-tropical conditions where the soils are nutrient poor there are a variety of shifting cultivation practices/ affluent small farmer practices of home gardens; (iii) in semi-arid/subhumid conditions water harvesting-water conservation-water management/soil conservation systems (iv) in arid/semiarid conditions combination of crops-trees-animals; (v) in commercial crops (coconut/arecanut) intercropping/ multiple cropping etc. In all these systems live stock are integrated and pastoral-silviculture practices have been developed. In addition all these traditional practices take the local socio-cultural-economic conditions along with themselves. It has been shown recently (Tejwani, 2008) that the Indian farmers have more trees outside the forest than on there are the state forest. The farmer are contributing not only to the economic security but also to the environmental/ ecological security. India at present has large scale programmes on agricultural/natural resources/watershed water resource development and management. These mostly address (even though they are for all) small/medium farmer’s and are aware of the livelihood/employment/ economic/ecological/environmental issues. What these programmes are not aware of is that all these practices are in danger of instability and destruction due to very severe pressures of human and livestock populations. It will be presumptious to anticipate what technology the World Congress on “Conservation Agriculture” may recommend for densely populated sub-humid/semi-arid/arid conditions of India (and for south Asia). There could be an Indian perspective which will be part of discussion and intervention.